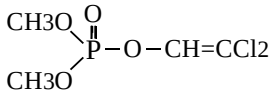
DICHLORVOS

Dichlorvos is a federal hazardous air pollutant and was identified as a toxic air contaminant in April 1993 under AB 2728.

CAS Registry Number: 62-73-7

Molecular Formula: $C_4H_7Cl_2O_4P$



Dichlorvos is a colorless to amber liquid with an aromatic odor. It is slightly soluble in water and glycerol, and miscible with aromatic and chlorinated hydrocarbon solvents and alcohols (Sax, 1987; HSDB, 1991).

Physical Properties of Dichlorvos

Synonyms:	phosphoric acid 2,2-dichloroethenyl dimethyl ester; phosphoric acid 2,2-dichlorovinyl dimethyl ester; o,o-dimethyl o-(2,2-dichlorovinyl) phosphate; dichlorophos; Dichlorovos; DDVP; SD 1750; Astrobot; Atgard; Canogard; Dedevap; Dichlorman; Divipan; Equigard; Equigel; Estrosol; Herkol; Nogos; Nuvan; Task; Vapona
Molecular Weight:	220.98
Boiling Point:	140 °C at 20 mm Hg
Density/Specific Gravity:	1.415 at 25/4 °C (water = 1)
Vapor Pressure:	0.012 mm Hg at 20 °C
Log Octanol/Water Partition Coefficient:	1.16
Water Solubility:	16,000 mg/l at 25 °C
Conversion Factor:	1 ppm = 9.04 mg/m^3

(Howard, 1990; HSDB, 1991; Merck, 1989; U.S. EPA, 1994a)

SOURCES AND EMISSIONS

A. Sources

Dichlorvos (DDVP) is registered as a wide-spectrum insecticide for the control of insects, spiders, and ticks. It is registered as a fumigant for the control of stored product insects in storage facilities, silos, shipping containers, and other areas. It is registered as an insecticide for use on ornamental lawns, in and around residences, food processing plants, eating establishments, and commercial and industrial buildings. It is also registered for insect control

in horse stables, barns, and milking stalls. It is also formulated as flea collars for dogs and cats, and as ear tags for beef and dairy cattle, and other livestock (DPR, 1996). Dichlorvos is also a breakdown product of the pesticide naled.

The licensing and regulation of pesticides for sale and use in California are the responsibility of the Department of Pesticide Regulation (DPR). Information presented in this fact sheet regarding the permitted pesticidal uses of dichlorvos has been collected from pesticide labels registered for use in California and from DPR's pesticide databases. This information reflects pesticide use and permitted uses in California as of October 15, 1996. For further information regarding the pesticidal uses of this compound, please contact the Pesticide Registration Branch of DPR (DPR, 1996).

B. Emissions

No emissions of dichlorvos from stationary sources in California were reported, based on data obtained from the Air Toxics "Hot Spots" Program (AB 2588) (ARB, 1997b).

C. Natural Occurrence

No information about the natural occurrence of dichlorvos was found in the readily-available literature.

AMBIENT CONCENTRATIONS

At the request of the Department of Pesticide Regulation, as part of the Toxic Air Contaminant Program under AB 1807, the Air Resources Board (ARB) conducted ambient air monitoring for naled and its breakdown product dichlorvos from May to June 1991 in Tulare County where it is used to control citrus thrips on oranges. Levels found at five monitoring sites ranged from less than 0.02 micrograms per cubic meter ($\mu g/m^3$) or 0.002 parts per billion (ppb) (the limit of quantification) to 0.059 $\mu g/m^3$ (0.007 ppb) (ARB, 1993h).

In June 1995, ARB conducted application air monitoring for naled and its breakdown product dichlorvos in Tulare County. Samples were collected before, during and for 72 hours after the start of a naled application to an orange grove. Dichlorvos concentrations ranged from not detected (<0.006 $\mu g/m^3$ or <0.0007 ppb for the 5 hour application period) to a maximum of 0.994 $\mu g/m^3$ (0.11 ppb) (ARB 1995g).

Dichlorvos was also detected in samples taken from Jacksonville, Florida in 1987 and 1988. Ambient concentrations of dichlorvos were as high as 148 nanograms per cubic meter (ng/m^3) (0.02 ppb) with a mean concentration estimated at 3.2 ng/m^3 (0.0004 ppb) (U.S. EPA, 1993a).

INDOOR SOURCES AND CONCENTRATIONS

In the Nonoccupational Pesticide Exposure Study (NOPES), 32 household pesticides were measured in 24-hour samples obtained inside and outside homes located in 2 cities. Approximately 70 homes in Jacksonville, Florida were monitored in each of 3 seasons, and approximately 50 homes in Springfield/Chicopee, Massachusetts were monitored in each of 2 seasons. The mean indoor concentrations of dichlorvos ranged from 24.5 to 135 ng/m^3 in Jacksonville and from 1.5 to 4.3 ng/m^3 in Springfield/Chicopee. For both cities, the mean indoor dichlorvos concentrations were higher than corresponding outdoor concentrations (Immerman and Schaum, 1990).

ATMOSPHERIC PERSISTENCE

Based upon the vapor pressure, dichlorvos is expected to exist almost entirely in the vapor phase in ambient air. Dichlorvos is expected to react in the gas phase with hydroxyl radicals, nitrate radicals and ozone, with the hydroxyl radical reaction dominating as a removal process based on literature data for simple organophosphorus compounds. Because of the estimated rate constant for dichlorvos reaction with hydroxyl radicals, the atmospheric half-life is estimated to be 1 day (Kwok and Atkinson, 1995).

AB 2588 RISK ASSESSMENT INFORMATION

Dichlorvos emissions are not reported from stationary sources in California under the AB 2588 program. It is also not listed in the California Air Pollution Control Officers Association Air Toxics "Hot Spots" Program Revised 1992 Risk Assessment Guidelines as having health values (cancer or non-cancer) for use in risk assessments (CAPCOA, 1993).

HEALTH EFFECTS

Probable routes of human exposure to dichlorvos are inhalation, ingestion, and dermal contact (Sittig, 1991).

Non-Cancer: Dichlorvos is an organophosphate-type acetylcholinesterase inhibitor. This inhibition allows acetylcholine to accumulate, thereby leading to over-stimulation of innervated organs (Sittig, 1991).

The United States Environmental Protection Agency (U.S. EPA) has established a Reference Concentration (RfC) of 5 x 10^{-4} milligrams per cubic meter, based on decreased brain cholinesterase activity in rats. The U.S. EPA estimates that inhalation of this concentration or less, over a lifetime, would not likely result in the occurrence of chronic, non-cancer effects. The U.S. EPA has established an oral Reference Dose (RfD) of 5 x 10^{-4} milligrams per kilogram per day for dichlorvos, based on plasma and red blood cell cholinesterase inhibition in male and female dogs, and brain cholinesterase inhibition in male dogs. The U.S. EPA estimates that consumption of this dose or less, over a lifetime, would not likely result in the occurrence of

chronic, non-cancer effects (U.S. EPA, 1994a).

No information is available on adverse reproductive or developmental effects of dichlorvos in humans. Animal studies have shown conflicting results (U.S. EPA, 1994).

Cancer: No information is available on the carcinogenic effects of dichlorvos in humans. There is limited evidence for increased incidence of tumors in animals. The U.S. EPA has classified dichlorvos as Group B2: Probable human carcinogen. The U.S. EPA has calculated an oral unit risk estimate of 8.3×10^{-6} (microgram per liter)$^{-1}$ for use in risk assessments. The U.S. EPA estimates that, if an individual were to drink water containing dichlorvos at 0.1 micrograms per liter over his or her entire lifetime, that person would theoretically have no more than a 1 in 1 million increased chance of developing cancer (U.S. EPA, 1994a). The International Agency for Research on Cancer (IARC) has classified dichlorvos as Group 2B: Possible human carcinogen based on no adequate data in humans, and sufficient evidence in animals (IARC, 1991).

The State of California has determined under Proposition 65 that dichlorvos is a carcinogen (CCR, 1996). The inhalation potency factor that has been used as a basis for regulatory action in California is 8.3×10^{-5} (microgram per cubic meter)$^{-1}$ (OEHHA, 1994). In other words, the potential excess cancer risk for a person exposed over a lifetime to 1 $\mu g/m^3$ of dichlorvos is estimated to be no greater than 83 in 1 million. The proposed recommended oral potency value for use in cancer risk assessments is 4.1×10^{-1} (milligram per kilogram per day)$^{-1}$ (OEHHA, 1994).